EPSC Abstracts
Vol. 11, EPSC2017-721, 2017
European Planetary Science Congress 2017

Thermal emission of the Eris-Dysnomia system

Cs. Kiss (1), T.G. Müller (2), E. Lellouch (3), E. Vilenus (4) and Á. Kóspál (1)
(1) Konkoly Observatory, MTA CSFK, Hungary (2) Max-Planck-Institut für extraterrestrische Physik, Garching, Germany
(3) LESIA, Observatoire de Paris, Meudon, France (4) Max-Planck-Institut für Sonnensystemforschung, Göttingen, Germany

Abstract

We present a thorough analysis of the far-infrared and submillimeter emission of the Eris-Dysnomia dwarf planet system. The systems shows a clear flux density excess at the shortest far-infrared wavelengths (70-100 μm) indicating the presence of the warm component in the thermal emission, in addition to the very cold (<30K) Eridian surface. We discuss several scenarios that could explain this excess emission.

1. Introduction

Eris is the 2nd largest dwarf planet known in the Solar system, with a size very similar to Pluto, and at the same time the most massive one. Its mass is known from the orbit of its moon, Dysnomia. The largest dwarf planets typically have very high (>50%) geometric albedos, and usually the same bright surface is assumed for the typically faint moons around them (see e.g. the Haumea system). While visible range photometric observations provide little information of the size and surface properties of these bodies, their thermal emission is an exteremly useful tool in unraveling their basic physical characteristics.

2. Observations

The Eris-Dysnomia system was observed with the PACS photometer of the Herschel Space Observatory at several epochs in the 70, 100 and 160 μmm bands in the framework of the TNOs are Cool! Open Time Key Program (Müller et al., 2009), as well as in dedicated Open Time Programs (PI: E. Vilenius). The latter observations are among the deepest ones ever taken with PACS photometer at 160 μm. Spitzer/MIPS 24 and 70 μm measurements were also taken at earlier epochs. Additional observations were performed with the ALMA millimeter array telescope system (PI: M. Brown), and resulted in a successful detection of Eris at three epochs, providing a strong constraint on the 873 μm flux.

3. Results

The analysis of the combined SED clearly shows that the observed thermal emission cannot be explained with a single, cold, high albedo terrain that is otherwise suggested by e.g. the occultation observations. An additional, warm (>40K) component is needed that in principle may be (1) dark terrain with suitable geometry configuration on the surface of Eris, (2) a large (D>500 km) and low albedo (pV<5%) Dysnomia, (3) hot (50 K) regions on the Eridian surface powered by cryovolcanic activity, (4) an extended ring of dark dust particles or (5) long-wavelength emissivity changes. We are giving a detailed comparison of these possibilities and evaluate the probabilities in the light of the current observations.

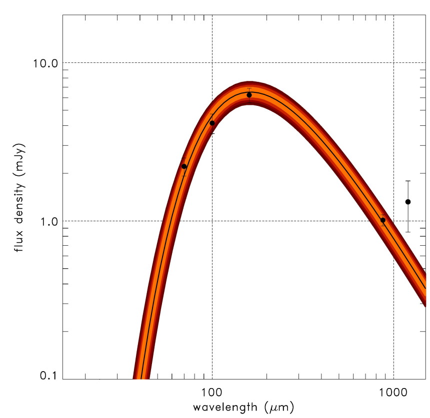

Figure 1: Spectral enegry distribution of the thermal emission of Eris. While the observed fluxes can be well fitted with a single terrain model (as shown in this figure) the corresponding size does not agree with the occultation results.

Acknowledgements

The research leading to these results has received funding from the European Union's Horizon 2020 Research and Innovation Programme, under Grant Agreement no 687378.